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ABSTRACT

The failure of the "open classroom" concept of the 1960's has not diminished the need for researchers to continue to look at learning and teaching to better understand how educational spaces can be improved for everyone that uses them. This document summarizes presentations made at the 1997 American Institute of Architects (AIA) conference on the importance of school design to those who work and learn within them. The following topics are covered: the learning process; educational technology; storage space; space allocated to other professionals visiting schools and the general community; changes in school design brought on by educational change and facility uses; and use of natural lighting. An additional presentation examines one school's efforts in meeting the diverse needs now demanded of it. A concluding section provides a list of resources resulting from a search of the AIA library and archives that address K-12 schools and architecture. (GR)

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Does Design Make A Difference?

September 27–28, 1997
Scottsdale, Arizona

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Does Design Make A Difference?

AIA Committee on Architecture for Education
September 27–28, 1997
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Introduction

The "open classrooms" of the 1960s were the result of the first widespread experiment in improving classrooms for teachers and students in the United States. Their ultimate failure is well known, but researchers have continued to look at learning and teaching to better understand how educational spaces can be improved for everyone that uses them.

Camp Twin Lakes, Rutledge, Ga.

Architect: Lord, Aeck, and Sargent

Permission from Camp Sunshine

The Learning Process

Learning is a very personal thing. Children and adults are most likely to remember—and learn from—peak experiences. Peak experiences, by definition, are discrepant, random, surprising, active, and have a strong emotional element. Bob Valiant, PhD, demonstrated this to the attendees using an overhead titled "That Was the Year That Was"—a list of historical events from one year. Though the events were political, economic, and historical, audience members able to identify the year all relied on personal experiences. Graduations, travels, and other personally relevant events keyed people in to wider world events occurring at the same time.

These peak experiences create connections in peoples' memories. Though the human brain is fully formed at birth, cells may later be used by sections of the brain for which they were not originally intended. It is possible for new dendrites and protein receptors to grow, and thus the accompanying synapses and the enhanced connections that we think of as memory. Experiences cause these new connections to grow. Teachers want their students to grow new dendrites and receptors, but long-standing teaching methods are routine, logical, passive, and neutral—not ideal for dendrite growth.

There are several theories of learning that focus on creating personally relevant patterns to enhance every student's learning. The New Intelligence model is experiential and reflective. The Multiple Intelligence model consists of eight separate kinds of intelligence and ways of learning, including linguistic and musical. The most widespread theory of learning today is Constructivism, which shares some ideas with both the New Intelligence and Multiple Intelli-

Kids and gorillas at zoo. Atlanta, Ga.

Photo: Jean Wineman

gence models. Constructivism is based on the student as an active participant in the learning process—learning is a communal activity, fostering cooperation, communication, and critical thinking. The learners must be actors in the process, learning by doing and learning from each other. The teacher's role is to facilitate learning for all, and to recognize that different people learn in different ways and to accommodate this.

Much research examining how student performance relates to building upkeep has been conducted. Glen Earthman discussed three compilations—by Weinstein, McGuffey, and Edwards—on this research. All of the studies examined demonstrated a relationship between performance, achievement, behavior, and the built environment, with four recent studies showing the standardized test scores of students in above standard schools being from 1 to 11 percentile points higher than those from students in standard buildings. More research needs to be done to better quantify these findings. However, we know that buildings influence attitudes, as John Eberhard discussed in his luncheon presentation, and that physical surroundings affect how people work. In spite of this, in 1996 the General Accounting Office reported that 60 percent of American school buildings had a major flaw, and 30 to 40 percent in every region had been deemed inadequate.

Gorillas at zoo
Atlanta, Ga.

Photo: Jean Wineman

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Technology

Just as researchers are changing the way we look at the learning process, new technologies are changing the way students and teachers locate information and do research. Computers, CD-ROMs, and the Internet have changed the traditional approaches to fact gathering. Students and teachers have fast access to a greater amount of information than ever before—and much of that information is instantly accessible. Up-to-date facts are also easier to locate than ever before, as researchers and governments have the ability to make them available before going through the traditional printing process. For some subjects, fact memorization has become obsolete, as the facts are constantly changing and updates are easily accessible.

As teachers have begun to apply the new theories of learning and new technologies in their classrooms, teaching styles and methods have begun to evolve. Michael Warden emphasized the new idea of teachers as managers of learning rather than as mediators of learning—because of information accessibility and rapid change, many teachers focus less on fact memorization and more on data retrieval and information management in certain subjects. Project-based groups are becoming more common as teachers look to encourage real-world skills such as cooperation, communication among peers, and critical thinking. These learn-by-doing projects are also designed to be interdisciplinary, which accomplishes several elements on any teacher's agenda—students see how their core knowledge can be used in a variety of disciplines, they apply facts to solve problems, and they learn how to tackle a project as part of a group.

Trinity School, Atlanta

Architect: Lord, Aeck, Sargent

Photo: Terry Sargent

Storage

Project-based groups are accentuating a problem teachers have long recognized—the lack of storage space in classrooms. With no offices of their own, teachers must store all class materials and projects in the classroom itself. When student groups are working on continuing projects, the storage problem becomes more acute. Student groups need easily accessible storage spaces to minimize daily un- and repacking, which can severely cut work time. Students often must use the same spaces for group and individual work, so projects cannot be left out overnight or after a class period is over. Counter and cabinet space in a classroom is often not adequate to accommodate a number of projects as well as other classroom equipment.

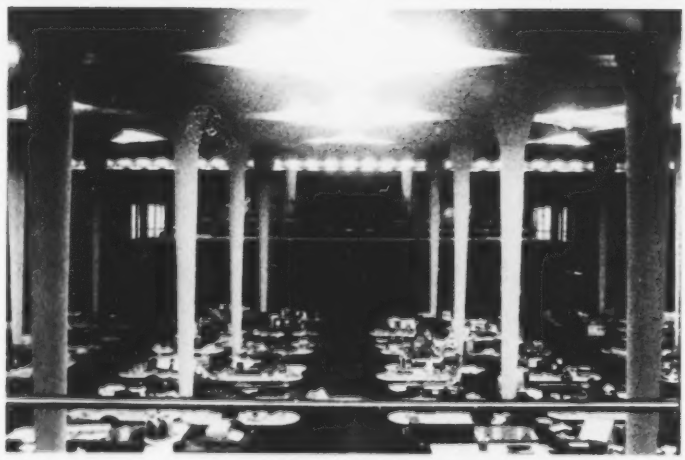
The lack of storage space is felt by teachers as much as students. In addition to organizing and distributing storage space to students, teachers need some of their own for supplies, books, and their records and tools. Teacher offices would be ideal for solving storage problems—providing additional storage space, a secure environment, and offering teachers a private space to hold meetings with students, teachers, or the various other professionals working in today's schools.

Other Professionals in the Schools

Just as teachers face limited storage and consultation space, the other professionals working in schools face an even more difficult situation. There is a variety of other professionals regularly visiting schools to work with students, administrators, and teachers. These social workers, juvenile justice workers, health workers, and others are not currently accommodated by most school designs. When many older school buildings were designed, there were few outside professionals visiting school grounds, so no space was provided them. However, many newer buildings have the same problems. These professionals have no office space, no private consultation space, and no storage space for pertinent files or records dealing with students at the particular school they are visiting. These needs are very real—for the confidentiality of their clients, for their productivity, for school communication, and for the organization of common workspaces.

Frank Lloyd Wright,
Johnson's Wax Building,
Racine, Wisconsin, 1949

Photo: Robert M. Craig

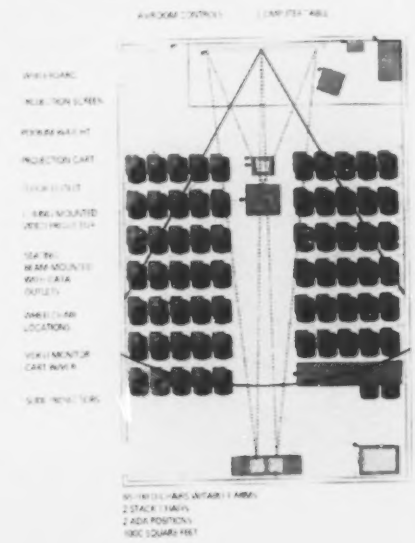


Community Users

These various professionals are not the only people visiting school grounds and buildings that have not done so in the past. Districts are facing increased taxpayer pressure to offer community access to school grounds and buildings for a variety of uses. As Thomas Heck, EdD, superintendent of the Litchfield Elementary District in Litchfield Park, Ariz., emphasized, a majority of voters do not have children and are unlikely to vote for school bond issues. A variety of community uses gives residents a stronger feeling of ownership and involvement in the school, which is helpful in passing new bonds for construction or repair. Community uses can be varied: sports leagues using the gyms or grounds; open pool use or swimming lessons; fully open public access to tennis courts or running track; community plays or entertainment in the auditorium; continuing education, Red Cross, or community college classes in the classrooms; or meeting spaces that clubs or local chapters could reserve. These various uses attract a wide swath of the public and make the school a center of the local community. However, such access creates a variety of concerns for parents, teachers, administrators, and students.

Multi-use schools commonly attempt to limit the public's access to various school buildings. However, this can be very difficult when the schools were not designed with this intent. Teachers, administrators, students, and parents raise security concerns when adult education classes occupy the same rooms as traditional student classes—what might happen to students' unfinished work or the teacher's desk and supplies? The adult education

Typical Multimedia Classroom



LAS InterActive

Multimedia classroom

Drawings: Lord, Aeck, Sargent

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students and teachers then face a similar problem—where to put any projects they might be working on for safekeeping until the next class. Similarly, athletic locker rooms and sports equipment can become jumbled, as can theatrical supplies for drama classes. Equipment can be broken or lost. Parents and teachers also worry about who might access the open buildings besides the evening students. If school facilities are designed with public access in mind, classroom or project areas can be locked off while still leaving access to the auditorium and meeting rooms. Secure areas can be provided for school and personal property in athletic locker rooms and other common areas. Additional, secure storage in classrooms would alleviate some of the problems.

Changes in School Design

As Jerry Bamburg explained, the changing nature of education and facility uses has not been accommodated by existing buildings, and often not by newly constructed buildings either. All of the presenters agreed that storage is a key issue. Teachers, outside professionals, students, and community users all need additional storage space. Ideally, classroom storage space would be ample, securable, and flexible enough to be used by single students, project groups, or class projects. Additional classroom storage for community classes and activities would be eagerly accepted by teachers and community members alike.

Storage and office space for the various social workers visiting schools is another need for many schools. Not every worker assigned to a school needs their own office, but all of these professionals need a place they can work undisturbed, store pertinent records, and meet privately with students, families, and teachers. Confidentiality is a very important consideration for many of the professionals, but they are currently strained to provide it to their clients.

Just as few schools have designated working and meeting space for outside professionals, very few schools have teacher offices and planning space. This is a need teachers feel strongly—to have a place they can plan their lessons and projects, store materials and records, and have private conferences with students or other professionals. In clusters, a staff planning room within each cluster can provide planning and layout space for individuals and groups.

The new emphasis on student group projects necessitates other changes in school design. Educators emphasize that project areas should be separate from the traditional classroom areas, so as to eliminate the need to put project work away at the end of a class or day. In her presentation, Dr. Jean Wineman compared these areas to the group work areas becoming more common in business settings. Just as traditional offices and

LAS office of Lord, Aeck, Sargent

Photo: Jean Wineman

personal work spaces are getting smaller and group work areas are getting larger in the business arena, educators are looking to maximize flexible group space while minimizing space for the traditional classroom, as students are spending less and less time working alone at a desk. Group areas should be flexible. They should accommodate a variety of group sizes, a variety of project types, and should provide technology hook-ups. There should also be storage space for a variety of supplies and student work, and at least some of the space should be securable. Additional storage space for community class use would also be ideal.

Trinity School, Atlanta

Architect: Lord, Aeck, & Sargent

Photo: Jonathan Hillyer

Meeting the New Needs

Architects and facilities planners are faced with quite a challenge to accommodate the needs of the various groups using today's schools—students, teachers, community members, and outside professionals. In order to maximize their success, planners must bring in some of the users to find out what the users at any particular school site have in mind.

For any project, the architects and planners must meet with the teachers and administrators. Before designing or renovating the school, they must know what is intended for it, who will be using it, and what plans they may hope to implement in the future. What age groups will be using the facility? Is that likely to change in the future? What types of classes must be provided for and in what proportions? What is the level of technology to be implemented, both at the present and in the future? Do the teachers have any particular wants or needs? Will community groups be using the school, and for what? Do teachers have particular concerns about any of the uses? The planners should also educate the users about current educational facilities design, and, to head off any later problems, it must be emphasized that the initial investment is important to long-term success.

Craig Zimring offered facilities planners three steps to take when beginning a school design project. Architects and planners will likely find themselves working with teachers and administrators from current and traditional school cultures, and their differences will have considerable importance to the school design. First, Zimring recommends structured facility visits. The decision makers and day-to-day design team should visit at least two schools anywhere in the country before making a finalized plan. The trips must be organized—with clear plans, scheduled interviews, and advance preparation completed. These visits must be documented and reported, and ideally would be made part of a data bank on school design.

The second step is to determine the problematic situations and the players involved. Briefing books can identify the nature of the conflicts and should focus on specific issues. With these resources, the architects and planners can work on resolving as many of the differences as possible. Lastly, the design team can utilize formative programming using problematic situations. The

decision makers should go through the problematic situations—role playing can be helpful. All conflicts and resolutions should be recorded to be added to the briefing books and data bank as is relevant. These sessions will enable the design team to better see the real issues at work, and to observe what points are truly most important to the various actors in the process.

From the Front Lines

Several school districts around the country have built or are building schools that attempt to fill these needs. Mary Scott, president of the Issaquah School Board in Issaquah, Wash., is also a seventh-grade teacher in a neighboring district. She has taught in a new school building for three years, and the Issaquah district built a new high school, a new middle school, and five new elementary schools in the last 15 years; they have also renovated existing schools and administration buildings. She discussed some of the things she and her districts have learned from these experiences. The schools have worked well, indeed, better than many expected. Clustering is successful, as is the cluster design they have settled on—six to eight rooms open onto a larger group work area, with windows separating the classrooms from the great room. The windows enable teachers to send smaller groups into the great room to work independently. They have also found things that could be improved in future school designs: teachers need secure space; the PTA needs a facility that could be shared with business people and parents visiting or helping on any particular day; signs must be obvious and welcoming to guests, community members, and parents; displays must be in the hallways where visitors and community users can see student work and what goes on in the school; the school must be adaptable to the changing curriculum and technology; drop-down storage might

Trinity School, Atlanta

Architect: Lord, Aeck, & Sargent

Photo: Jonathan Hillyer

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solve the space crunch; libraries must be large; and corridors must be able to handle the population of the school.

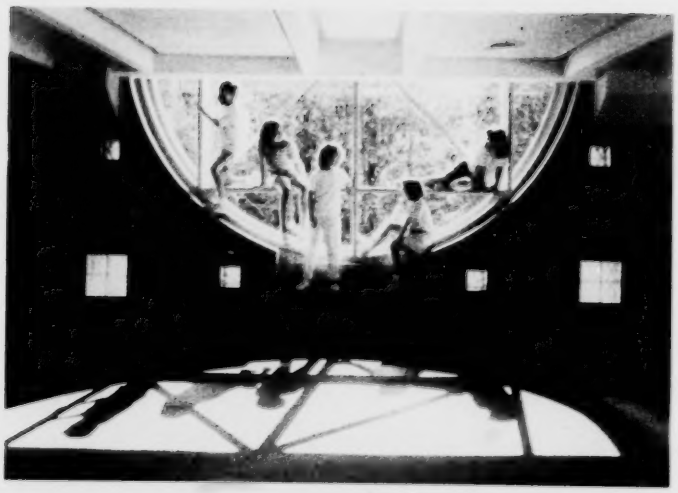
Cheri Hendricks, architect and design and construction manager for the Edmonds School District in Washington shared similar experiences. Hendricks's current project is a 1,600-student high school. The Edmonds School District last built a high school in 1991, which was state-of-the-art at the time. A post-occupancy analysis of the earlier school was conducted, with 10 percent of students and all teachers and support staff being interviewed. Using these responses, the design team came up with an even more innovative design. The new school is currently under construction.

Hendricks's team examined several layout models for high schools. They also brought in the staff and teachers of the 1991 high school to hear their opinions of what worked, what did not, and what they thought might suit their needs more effectively. In the design for the new school, the team implemented solutions to many of the reported problems. Core classrooms were downsized to 800 square feet based on the teachers' assessments of the older school; they made the learning lab areas larger, to approximately 1,250 square feet; and they completely revamped the staff planning areas—in the older school, teachers were taking over classrooms due to the lack of preparation space. The new school will have individual and group work stations, additional layout space, and a kitchen area in the prep rooms. They also split the theater area into two spaces—one for drama, the other being a combination cafeteria and music hall. The drama area in the older school turned out to be too large for the students' voices, and too large for the typical audience.

The design team worked with the teachers to determine an optimum size and configuration for the clusters. The entire school, with the exception of the art and theater areas, consists of linked clusters. The art and theater areas will be used by the community and can be accessed when the rest of the school is locked. The science labs are together in their own clusters—the design team wanted to integrate them, but the teachers did not. The team compromised by designing the clusters so the plumbing can be easily reconfigured to accommodate science labs in the future.

The design team also managed to provide natural light to nearly every space. Since there had to be some interior rooms, the team chose to place the staff

planning areas, the conference and seminar rooms, and storage areas in the interior. They chose these areas because individual teachers typically spend only an hour or two per day in the planning room, and the meeting rooms are similarly used. The classrooms and lab areas, on the other hand, are utilized all though the day by large numbers of people.



Trinity School, Atlanta

Architect: Lord, Aeck & Sargent

Photo: Jonathan Hillyer

Lighting

Providing natural light is a very important part of school design. Natural light helps to minimize energy use and utility bills, and people prefer it. Paul Grocoff, PhD, spoke on a study he conducted, for which he examined student behavior and perceived behavior in different lighting environments. He found that, under the lighting systems he tested (natural, 3000K, 4100K, 5000K, 6500K), the students felt the worst under the traditional classroom lights—3000K. The teachers also felt their behavior was not at its best. The students felt the best, and the teachers felt they behaved at their best, under skylights. The students found the natural light to be comfortable, the teachers appreciated the low glare, good color rendering, and good behavior under this light for the students. The lighting in a school is just another facet of what the design team must plan for when designing the school layout. The lighting affects student feelings, behavior, concentration, and therefore their learning. Teachers and other staff are also affected.

Conclusion

It is vital to be especially careful when designing educational facilities. There is no formula for designing a perfect school—the site, the classes to be taught, and the various uses of the facility must be examined. Teachers, administrators, and other decision makers should have input into the design process—they will be using the facility and must live with its successes and the failures. The fields of education and teaching have changed dramatically in the thirty years since the Open Classroom experiment, and all members of the design team should be aware of the latest developments—and it is absolutely necessary to know which theories and systems the teachers at any particular school will be employing. As the presenters all emphasized, flexibility is key, as theories, technology, and possibly even the age groups attending will change in the future.

Resources

AIA Library and Archives QuickSweep Report

re:earcher: Carole Twombly, reference librarian
phone: (202) 626-7493; fax: (202) 626-7587; e-mail: library@aiamail.aia.org

SUBJECT: SCHOOLS K-12

The results of a quick search are listed below:

Citadel (*The Avery Index to Architectural Periodicals* online)

Most of these articles can be photocopied for a fee of $10.00/article (member), or $15.00/article (non-member) plus appropriate copyright fees.

Keywords: Preschools; Schools, United States (not college or university or additions/alterations)

Title: Design competition launches Head Start building campaign/ Ann C. Sullivan.
Physical Details: computer drawings, elevations, models, plans.
In: Architecture 1995 June, v.84, n.6, p.22-23, ISSN 0746-0554.
Notes: "Patterns for Head Start Facilities" competition to create a working model facility in East Windsor, N.J. 1st prize: H. Fardjadi, S. Fardjadi, and C. Scott. 2nd prize: O'Brien Designs. 3rd prize: Jones Partners. 4th prize: Lahn Architects.

Title: Designing for Head Start / Lisa D. Fischetti.
Physical Details: drawings, elevations, models, plans, sections.
In: Competitions 1995 Spring, v.5, n.1, p.14-27, ISSN 1058-6539.
Notes: "Patterns for Head Start Facilities" competition to create a working model facility in East Windsor, N.J. 1st prize: H.Fardjadi, S.Fardjadi and C.Scott. 2nd prize: O'Brien Designs. 3rd prize: Jones Partners. 4th prize: Lahn Architects. Four other entries also featured.

Title: Head Start Child-Care Facilities: Homa Fardjadi, Sima Fardjadi, Craig Scott.
Physical Details: drawings, models, plans, site plans.
In: Architecture 1996 May, v.85, n.5, p.126-127, ISSN 0746-0554.
Notes: Winning competition entry for prototypical building. Site was in East Windsor, N.J.

Title: Head Start school competition.
Physical Details: models, plans.
In: Progressive architecture 1995 Apr., v.76, n.5, p.37, ISSN 0033-0752.
Notes: Competition for prototypical Head Start school for a site in East Windsor, N.J. Winning architects: Homa Fardjadi Sima Fardjadi, Craig Scott. Also features second and third place schemes.

SCHOOLS

Title: Campus community / Susan Williamson.
Physical Details: photos, plans, axonometric drawings.
In: Texas architect 1997 Jan.-Feb., v.47, n.1, p.70-73, ISSN 0040-4179.
Notes: Spanish summary. Rice School in Houston. Architects: Taft Architects.

Title: Classroom clusters / Susan Williamson.
Physical Details: photos, plans.
In: Texas architect 1997 Jan.-Feb., v.47, n.1, p.74-75, ISSN 0040-4179.
Notes: Spanish summary, p.74. Claude Curtsinger Elementary School in Frisco. Architects: Corgan Assoc.

Title: The dean's list / Jane Brown Gillette.
Physical Details: ports.
In: Landscape architecture 1997 Apr., v.87, n.4, p.48,50-53, ISSN 0023-8031.
Notes: Four landscape architects, Deborah Dalton, Robert Melnick, Dennis Law, and Neil Porterfield, serve as deans of multidisciplinary design schools.

Title: Interview with Stanley Tigerman and Eva Maddox / John Czarnecki.
Physical Details: photos, ports.
In: Crit 1997 Winter, n.38, p.30-33, ISSN 0277-6863.
Notes: Interview with the co-founders of Archeworks, an alternative architecture school in Chicago.

Title: Long Beach International Elementary School, Long Beach, Calif., Morphosis and Thomas Blurock Archts / Ned Cramer.
Physical Details: models.
In: Architecture 1997 Aug., v.86, n.8, p.41, ISSN 0746-0554.

Title: Morphosis: Diamond Ranch High School [Diamond Bar, Calif.].
Physical Details: computer drawings, models, plans.
In: Architecture 1997 Jan., v.86, n.1, p.[68-71], ISSN 0746-0554.

Title: Un padiglioue aperto = Temple Hoyne Buell Hall / Remo Dorigati.
Physical Details: computer drawings, photos., plans, site plans.
In: Arca 1997 May, n.115, p.34-41.
Notes: School of architecture at the Univ. of Illinois at Urbana-Champaign. Architects: Perkins & Will. Text in Italian and English.

Title: Reclaiming a symbol / Susan Williamson.
Physical Details: photos, plans, site plans.
In: Texas architect 1997 Jan.-Feb., v.47, n.1, p.66-69, ISSN 0040-4179.
Notes: Spanish summary, p.62. Ball High School in Galveston. Architects: Bay Architects.

Title: Saving the soul of architectural education: four critical challenges face today's architecture schools / Lee D. Mitgang.
Physical Details: photos.
In: Architectural record 1997 May, v.185, n.5, p.[124]-130, ISSN 0003-858X.
Notes: The challenges are: use computers to connect students to a world of viewpoints, end apartheid, make excellent teaching a priority, and connect learning to life. Includes list of schools with programs currently accredited by NAAB.

Title: School Architecture.
Physical Details: photos.
In: Texas architect 1997 Jan.-Feb., v.47, n.1, p.47-48,50,52, 54-57,59, ISSN 0040-4179.
Notes: Eight winners in the 1996 Exhibit of School Architecture.

Title: School colors / Jane Margolies.
Physical Details: photos, ports.
In: House beautiful 1997 May, v.139, n.5, p.[88], ISSN 0018-6422.
Notes: Industrial designer Ruth Lande Shuman works with students in New York City schools to repaint their school interiors in vibrant colors chosen by the students themselves.

Title: Il sogno di Cranbrook / Marsha Miro, Mark Coir.
Physical Details: photos., aerial photos., ports., site plans.
In: Casabella 1997 Apr., v.61, n.644, p.2-[19], ISSN 0008-7181.
Notes: In Italian and English. Includes bibliographical references. History of the Cranbrook Academy of Art campus, Bloomfield Hills, Mich., and work there by Eliel Saarinen, Juhani Pallasmaa, Bertram Goodhue, Carl Milles, and others.

Title: Split-level flexibility / Kelly Roberson.
Physical Details: photos, plans.
In: Texas architect 1997 Jan.-Feb., v.47, n.1, p.76-77, ISSN 0040-4179.
Notes: Spanish summary, p.76. Chisolm Trail Intermediate School in Keller. Architects: Hahnfeld Assoc.

Title: Advancing public and professional concerns: School of Architecture, Florida A&M University / Tom Puch.
In: Florida architect 1996 Winter, v.43, n.4, p.14, ISSN 0015-3907.

AIA Library Subject File

Most of these articles can be photocopied for a fee of $10.00/article (member), or $15.00/article (non-member) plus appropriate copyright fees.

Keywords: Schools:

"The Impact of school buildings on student achievement and behavior: a review of research." *PED Exchange*, Issue 30, February 1997, 5pp.

Sabo, Sandra R. "Shaping school design." *American School Board Journal*, October 1996, p. 42-44.

Boynton, Rodney S. and Daniel W. Cecil. "Evaluating your space." *AS&U*, August 1996, p. 66-70.

"Monuments to reform." *Education week*, April 3, 1996, p. 19-25.

"School design: Crisis, educational performance and design applications." *Children's Environments*, 10(2), 99-112.

Vitruvius (AIA Library and Archives online card catalog)

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Keywords: Schools:

Call#: LB3222.5.C66 1995
Title: Community use of schools.
Imprint: Celina, OH: Fanning/Howey Associates, Inc., 1995.

Call#: LB3221.N436 1992
Title: New Schools for New York: plans and precedents for small schools.
Imprint: New York: Princeton Architectural Press, 1992.

Call#: LB3221.D84 1992a
Author: Duffy, Patrick Michael
Title: Classrooms and their users: a conceptual mapping of research on the physical environment of schools.
Imprint: Ann Arbor, MI: UMI Dissertation Services, 1992.

Call#: LB3218.A1 O78 1993
Author: Ortiz, Flora Ida
Title: Schoolhousing: planning and designing educational facilities.
Imprint: Albany, NY: State University of New York Press, 1994.

Call#: LB3218.A1 G73 1993
Author: Graves, Ben E.
Title: School Ways: the planning and design of America's schools.
Imprint: New York: McGraw-Hill, 1993.

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They also have a web site (http://www.cefpi.com/cefpi) which includes their journal "Educational Facility Planner" [which is searchable from 1963 to the present] and various reports that might be useful.

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